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Study on the Impact of Green Credit on Carbon Emission Reduction in the Manufacturing Industry

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Abstract:

This study aims to explore the impact of green credit on carbon emission reduction in the manufacturing industry. As China actively promotes its "dual carbon" goals, green credit has become increasingly prominent as an essential policy tool in the manufacturing industry. This article first conducts a literature review on green credit and carbon emission reduction in the manufacturing industry, sorting out existing research's main findings and perspectives. Subsequently, the current challenges and potential development opportunities are revealed by analyzing the development status, problems and future trends of green credit and carbon emission reduction in the manufacturing industry. We further used the SWOT and PEST analyses to conduct an in-depth analysis of the impact of green credit on carbon emission reduction in the manufacturing industry and identified its internal and external factors. Finally, this article puts forward corresponding countermeasures and suggestions, aiming to promote further the application of green credit in the manufacturing industry and promote carbon emission reduction work to achieve more significant results. This study will deepen our understanding of the mechanism and effect of green credit in carbon emission reduction in the manufacturing industry and provide a valuable reference for formulating and implementing relevant policies in the future.

Keywords: Green credit;Carbon emission reduction;SWOT;PEST.

1. Introduction

Building a solid financial nation is the clear objective of the Central Financial Work Conference, which took place in October 2023. Finance should offer top-notch services to support social and economic progress. It also made the point that to support the real economy's high-quality development; the financial sector should publish five significant articles on technology finance, inclusive finance, green finance, pension finance, and digital finance in reform and innovation. Among these five articles, green finance is ranked first. It should continuously invent new green products and adjust to the demands of the Chinese double carbon policy as well as the global green transformation. China has worked hard to create green professional institutions and a green financial standard system in recent years, placing a high value on the growth of green finance. China is currently a significant player in the global green finance sector. By the end of 2022, the Chinese green credit balance in both local and foreign currencies had increased to 22.03 trillion yuan, up 38.5% from the previous year, and the total amount of green bonds issued had reached 286.9 billion US dollars.

The Ministry of Industry and Information Technology organized a symposium on January 8, 2024, to encourage the low-carbon and green development of the manufacturing industry. The seminar made the point that the manufacturing sector needs to gradually reduce its carbon emissions, create a green manufacturing and service system, encourage resource conservation and efficient use, and expedite the development of a green energy system. The Ministry of Industry and Information Technology and seven other departments proposed on March 1, 2024 that by 2030, the manufacturing sector would have achieved remarkable progress in transforming to a low-carbon and green economy. The overall level of green development of traditional industries would also rise, the industrial structure and layout would be greatly optimized, the ratio of energy utilization for low-carbon and green industries would be greatly improved, the intensity of pollutants and carbon emissions would be significantly reduced, and the total amount of carbon emissions would reach a peak.

Studying how green credits affect the manufacturing sector's reduction of carbon emissions is very important from both a theoretical and practical standpoint, especially with the backing of the aforementioned connected regulations. This paper first collates the literature on how green credit affects carbon emission reduction in the manufacturing industry. Next, the industry's current development status,

problems, and future trends in carbon emission reduction and green credit are systematically analyzed. The paper then systematically explores the development of industrial carbon emission reduction and green credit by using PEST and SWOT analysis models. Finally, the article presents the corresponding countermeasures and suggestions for the current situation.

This paper's general concept is as follows:

First, compile pertinent literature on how green credit affects the manufacturing industry's carbon emission reduction.

Subsequently, systematically analyze the industry's carbon emission reduction and green credit development status, issues, and future trends.

Then, employ the PEST and SWOT analysis models to systematically analyze the industry's carbon emission reduction and green credit development situation.

Finally, propose appropriate countermeasures and recommendations.

2. Literature review

2.1 Research on the Green Credit

In China, "green credit" refers to sustainable development and environmental conservation financing. This idea is equivalent to "sustainable finance" or "environmental finance" in other nations. The current focus of green credit research is on economic transformation and sustainable development.

2.1.1 the Green Credit and sustainable development

Using the event research method, Sebouh and Patricia (2007) examined the loan announcements of 152 Canadian companies and data on banks' supervision effectiveness under environmental responsibility. They also discussed how banks can manage loan risk by allowing only clean firms in polluting industries to apply for loans and through borrower self-selection and bank supervision. The findings indicate that the stock market reacts more actively to bank loans issued by environmentally friendly businesses than non-green businesses. Hu Naiwu (2011) contends that a healthy environment is essential for the economy to grow sustainably. China has advanced the idea of sustainable economic development and transformation, which calls for altering the mode of development and creating a resource-conscious and environmentally friendly society. To do this, commercial banks must provide green financing as a means of support. According to Martina and Tom (2016), who concentrate on how environmental changes affect the financial aspects of businesses in the sector, ecological changes present opportunities for expanding corporate wealth. As a result, companies must adapt to these changes, and sustainable economic transformation is crucial.

Additionally, it makes the case that future research on environmental investment should focus more on the government and financial sectors and that it can help solve issues with optimal fund allocation, management, and integration of adaptation and mitigation. The relationship between endogenous credit funds and company energy efficiency under the regulatory framework was investigated by Marco and Bulent (2018) using the Eurace model. Academics contend that the current state of the economy has a gap in green investment. The banking regulatory framework requires banks to lend more money to businesses engaged in green investments to channel credit funds into the green sector and close the green investment gap. However, with time, this influence's strength varies. In the short term, proper oversight can encourage investment and capital accumulation and enhance businesses' energy efficiency; nevertheless, fewer mortgage loans will negatively affect private credit and lower demand. Over time, green regulations have had minimal beneficial effects on capital and energy efficiency. Green credit policy can effectively limit the expansion of backward production capacity for enterprises in heavily polluting industries while also supporting these enterprises' green transformation, according to Shu Limin and Liao Jinghua's (2022) analysis of green credit from the perspectives of environmental protection and investment in heavily polluting industries. Additionally, it has been discovered that green credit can direct the flow of capital through businesses since it helps to invest in green transformation in highly polluting industries, even though this benefit is not very important for terminal governance. Although the impact of green credit varies depending on the region and level of market competitiveness, it helps expand the amount of green credit borrowed.

2.1.2 The Green credit and economic transformation

Domestic experts have produced numerous study accomplishments on green credit and economic change. By examining China's province panel data from the previous ten years, Xie Tingting and Jinhua Liu (2019) illustrated the impact of green credit on economic growth and examined its mechanism and realization path. According to the findings, green finance does help the green economy grow, but environmental regulation aspects have a negative impact. This could be because environmental pollution firms in China are currently costly and need to make more profit. Green credits can also encourage the advancement of technology as well as the modernization and restructuring of the industrial structure.

In conclusion, China's green credit development still has a long way to go and numerous limitations. To ensure that

the government takes the lead and that bank financing and enterprise innovation work together to support the expansion of the green economy, we should enhance the green credit policy and set up an incentive system. In their analysis of the impact of green credit on industrial structure upgrading in China, Li Yu et al. (2020) concluded that while green credit has a positive and significant influence on upgrading industrial structure in the western, central, and eastern regions of the country, it hurts the tertiary industry. Guojun (2021) thinks that in light of China's "14th Five-Year Plan"'s economic transition, we should actively advance green finance, enhance evaluation criteria, expand pertinent financing channels, and create innovative green product systems. To ensure that green finance policy can genuinely fulfil the financial support function of monetary policy, we should consider the experiences of all relevant parties, actively investigate and develop, and create the framework at the highest level possible. Li Tao (2021) states that China requires green financing to develop a recyclable, low-carbon, and green economic system. While it is essential to support the development of the carbon market system and enhance its mechanism, we also need to combine the carbon market with the green financial market, fortify financial support for green finance, and steadily increase the number of carbon market transactions. Although China's green credit has grown in recent years, Liang Lingjie (2022) noted that there are still issues, such as more administration and monitoring. The encouragement of a monitoring force and the assurance of a monitoring system are also necessary for the green credit industry's quick development. To strengthen the development of green credit talents and improve pertinent laws and regulations, scholars believe that the information disclosure requirements of green credit should be improved, guided by the law and encouraged by the policy and that references to the US "potential responsible person" system and the international Equator Principles should be made.

2.2 Research on carbon emission reduction

According to Zeng et al. (2019), technological advancements and international trade guarantee enhanced carbon emission reduction performance. Cleaner industrial technology is, without a doubt, the key to improving environmental quality, but this does not imply a direct correlation between environmental quality and technological advancement (Lu Na et al., 2019). When significant funding is required to sustain technological research, technological advancement will not increase production efficiency due to accumulation and threshold effects (Huang et al., 2021). Furthermore, Wang et al. (2019) noted that technological advancement in the industrial sector will not result in a decrease in carbon emissions after taking into account the bias of technological progress. Instead, they suggest that the rebound effect of carbon emissions will likely be caused by the increase in production capacity brought about by pure technological advancement.

According to Zhu Min et al. (2023), achieving carbon neutrality does not require compromising economic growth. However, balancing transformation costs with the benefits of emission reduction is essential. As a result, measuring the performance of reducing carbon emissions has gained importance in environmental economics. The cost of carbon emissions and the coupling relationship between ecological factors and the social economy are both reflected in the performance of total factor carbon emission reduction. The input-output connection constructs the production frontier, and the deviation of actual emissions from the theoretically ideal value on the frontier measures the performance of carbon emission reduction (Yu & Zhang, 2021). There is improved coordination between economic growth and decreased carbon emissions since increased productivity and the positive externality of environmental conservation are reflected in increased carbon emission efficiency (Fang et al., 2022).

2.3 The Impact of green credit on carbon emission Reduction in the manufacturing industry

The key to the manufacturing industry's green and efficient development is improving manufacturing enterprises' production efficiency and promoting green growth. Carbon emission reduction in the manufacturing industry can effectively measure the manufacturing industry's green and efficient development level. As an environmental regulation tool, green credit has three paths: capital formation path, resource allocation path, and cost increase path. On the path of capital formation, green credit strictly restricts the loans of enterprises in high-pollution manufacturing industries. It raises the financing threshold, limits enterprises' production scale in high-pollution manufacturing industries, and reduces pollution emissions. Simultaneously, green credit will augment the financial assistance provided to businesses operating in the green and clean manufacturing sector, facilitate the growth of those businesses, and aid in the environmentally conscious advancement of low carbon and emission reduction.

Regarding resource allocation, green credit can draw investors into the clean and green manufacturing sector by allocating capital efficiently. It can also encourage the growth of this sector and stop high pollution and high-carbon emission behaviour at its source. On the path of cost increase, when the intensity level of green credit is too high, businesses in high-pollution manufacturing indus-

tries must invest a lot of money and technology in pollution control to cross the high credit threshold set by banks. It raises the costs associated with financing and pollution control for businesses, partially stifles their growth, and lessens the beneficial effect of reducing carbon emissions.

As an essential carrier of green finance, green credit undertakes the responsibility of recommending green projects to the market and sends a low-carbon economic signal. At the same time, green credit will also send a signal to private capital to guide and encourage social capital to enter green, low-carbon projects through direct financing (Xu & Jiang, 2021). Under the indirect financing system in China, financial intermediaries with banks as the main body are important carriers in realizing the signal transmission path. The state promotes the establishment and improvement of the green credit market and sends encouragement and warning signals to low-emission and high-emission manufacturing enterprises through incentive policies, access policies, and punishment means, which will force manufacturing enterprises to make adjustments in the same direction based on future expectations and the company's long-term development needs. After receiving the warning signal, high-emission manufacturing enterprises must carry out green transformation and upgrading to achieve carbon emission reduction to avoid the existing punishment and the rapid increase in the cost of expected emissions (You Zhiting et al., 2022).

3 The development and problems of green credit

3.1 The development status of green credit

3.1.1 The scale of green credit

China's green credit scale grew from 5.2 trillion yuan in 2013 to 22.03 trillion yuan in 2022, an increase of more than four times, and the issuance scale has ranked first in the world, according to China's annual Report on Social Responsibility of Banking Industry in China and official websites like the People's Bank of China. That will not, however, be sufficient to aid China's transition to a green economy and meet the "double carbon" target. Based on information released on the People's Bank of China website, the percentage of green credit in China has only increased from 6.79% in 2013 to 10.05% in 2022 (local and foreign currencies). Ninety per cent of these loans still require guidance, so much room for improvement exists. The primary cause is that most of China's industries continue to choose the conventional energy structure. The lack of scale effect and small amount of green credit makes it impossible to meet the demands of green development and slow down the rate of green transformation.

In addition, the People's Bank of China reports that the asset quality is generally good and that the average non-performing loan (NPL) ratio for green credit in China from 2017 to 2021 was 0.4%, or one-third of the total NPL ratio for banks. The average growth rate of green credit is 11.89%, which is less than that of bank credit, suggesting that the issue of insufficient motivation persists.

The People's Bank of China reports that, of the country's leading publicly traded commercial banks, the Industrial and Commercial Bank of China has the highest green credit balance in 2021—roughly 2,480.621 billion yuan. Concurrently and consistent with the nature of state-owned commercial banks, the scope of green financing these institutions offer surpasses city and joint-stock banks. Because they are directly under state supervision, state-owned commercial banks naturally follow the state's lead and set an example in implementing green finance. Furthermore, the state-owned commercial banks are well-funded and engaged in various industries, so the new green credit market is unlikely to affect them significantly. However, because of the delayed industrial green transformation and the immature domestic green credit market, joint-stock banks, city commercial banks, and rural commercial banks have not grown as much. As a result of their logical caution over the green credit industry, their scale will be modest.

The People's Bank of China reports that, in terms of industries, 84% of China's green credit usage in recent years has gone toward financing renewable energy and energy conservation, infrastructure upgrades, and environmental protection. This has to do with China's development objectives. The Communist Party of China's report to the 20th CPC National Congress noted that most green loans invested in the three industries above are logically directed toward advancing the energy revolution, bolstering the efficient use of coal, and accelerating the new energy system. However, according to the policy objectives, there is still much space for improvement, with the clean energy industry accounting for 26% of the total. When it comes to industries, the sectors that have invested in green credit the most in China are transportation, warehousing, postal services, and the industries that add up to match the supply of power, heat, and other utilities. It demonstrates that most of China's green credit is allocated to transportation and energy projects, with less funding for different initiatives. Green credit investments are typically single-source, concentrated, and require diversification.

3.1.2 The Green Credit Policy

With the 1995 Notice on Issues Related to Implementing Credit Policy and Strengthening Environmental Protection, which proposed integrating environmental protection

into bank loans, China's green credit policy started. The effect of this declaration could have been better, as China was still experiencing fast economic development at the time and had yet to make significant attempts to carry out economic transformation. The central bank's publication of the Notice on Issues Related to Sharing Environmental Protection Information of Enterprises enhanced the information system 2006. Most academics studying China's green credit policy believe that the country's history began with the 2007 Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks. The rationale is that domestic overcapacity became noticeable, and macro-control concentrated on changing the economic development model and the economy's structure. China's green credit policy system was then supplemented and improved by several documents released by the country's central bank, China Banking Regulatory Commission, and environmental protection departments. These included the Green Credit Guidelines in 2012, the Statistical System of Green Credit in 2013, and the Key Evaluation Indicators of Green Credit Implementation in 2014. These documents progressively unified the measurement standards of green credit, enhanced its risk management, and improved its information disclosure. Green credit's significance was emphasized in the Guiding Opinions on Building a Green Financial System in 2016, and green credit was formally elevated to green finance in the Green Finance Evaluation Plan for Banking Financial Institutions in 2021.

Overall, China's green credit policy system has been continuously improving in recent years, starting with the stringent credit project audit and continuing through the development of information exchange channels between banks and businesses, the creation of financial products related to green credit, the development of a green credit statistical system, and an assessment mechanism. However, there are several drawbacks, like an abundance of guidance documents and a shortage of more precise regulations, which can encourage certain commercial banks to apply the green credit policy haphazardly or not due to a lack of competitors. The domestic green credit strategy is currently in its exploratory phase, and the actual implementation of commercial banks must coexist with the planning of the next step. Overall, the significance of green credit has progressively increased to unprecedented levels. In recent years, more commercial banks—city or rural, listed or unlisted—have begun to publish corporate social responsibility reports on their official websites, outlining their green finance policies.

3.1.2 The Green Credit Policy

The following categories extensively use China's commercial banks' green credit initiatives. Loans for green PPP projects include the first group. Social capital and the government are partners in this endeavour. Social capital oversees project design, building, operation, and maintenance; the government oversees pricing and quality. The key goal is to support pollution prevention and control, particularly in public infrastructure. Credits for green energy efficiency make up the second category. The primary goals of the green loan are clean energy use and green equipment upgrades for businesses to assist them in becoming more energy efficient and consuming less energy overall. The third category is green investment and loans. Commercial banks invest in environmental protection enterprises and provide operating funds for environmental protection enterprises in the form of "equity+creditor's rights". The fourth category is carbon trading credit. Commercial banks pledge their carbon trading rights or carbon quotas to provide loans to qualified energy-saving and emission-reduction enterprises. The fifth category is personal green credit. It is manifested in the green loans designed and issued by commercial banks for individuals, mainly for private consumption.

The above categories are green credit projects widely used by domestic commercial banks. In addition, commercial banks have also made various innovations based on their actual conditions. Green credit projects abroad are similar to those in China, mainly divided into green energy, buildings, and consumption. Specifically, green energy loans primarily support enterprises developing renewable energy and improving energy efficiency. For example, Citigroup considers the carbon emission cost of the project in the loan review and prioritizes providing preferential loans to new energy power generation projects. In terms of green building loans, commercial banks will issue loans based on the green building logo issued by the government, such as the "Energy Star" rating mark of the US Environmental Protection Agency, the "Energy Certificates" of different grades in Germany, and the new apartments of other stars in Japan.

Regarding green consumer loans, banks cooperate with green enterprises such as new energy automobile manufacturers and photovoltaic technology manufacturers to provide preferential interest rate loans to customers who purchase products from such enterprises. The Bank of Japan will also launch green credit cards, where cardholders can enjoy discounts on green products and services, and banks will also donate a certain percentage of their income to green organizations such as the Worldwide Fund for Nature. Most domestic and commercial banks are learning from foreign experience and actively exploring localized green credit products. However, judging from

banks' implementation, most green credit products still need to be distributed to enterprises, and the landing effect of individual-oriented green credit products could be better, which cannot meet the multi-level green financial needs of retail customers.

3.2 The problems of the Green Credit

The first problem is that Green Credit still needs to form a unified standard, and there are communication barriers between banks and enterprises. The formal inception of domestic green credit dates back to 2007, when China released the Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks. Since then, the scope of green credit validation has been continuously split. Nonetheless, the currently available documents, such as the Special Statistical System for Green Loans and the Key Evaluation Indicators for the Implementation of Green Loans, primarily use the dimensions of industry, quality, and use, and the items are categorized into numerous broad categories. In the execution of commercial banks, certain statistical elements may need to be duplicated and clarified in the absence of a more precise subdivision, and ultimately, bank statistical results cannot be compared. At the same time, some quantitative and qualitative indicators may not apply to all commercial banks. In the latest Green Finance Evaluation Scheme for Banking Financial Institutions, the central bank evaluates 24 major banking financial institutions, and its content is limited to large and medium-sized commercial banks, which may not be suitable for small commercial banks. Therefore, when the peers want to compare green credit, they may get less accurate results.

The second problem is that the audience of green credit products is single, and corporate credit accounts for the majority. Combined with the numerous green credit initiatives implemented in China, most commercial banks' green credit is still allocated to public loans, with relatively little going toward private loans. Use Industrial Bank as an illustration. One of the commercial banks with a long history of involvement in green finance is the Industrial Bank, the first "Equatorial Bank" in China. Industrial Bank's green credit is mainly based on traditional energy-saving and environmental protection project loans and related innovative financial products, such as loans for the construction of new energy facilities such as water conservancy, wind energy and natural gas, environmental protection loans such as "Green Creation Loan" to help waste sorting pilot, and energy-saving loans such as "Water Saving Loan" to help save resources. Secondly, support loans for green ecological projects such as general agriculture and forestry, such as pledge loans for forestry carbon sink accounts, help enterprises revitalize "green assets". Finally, there are green credit products for individual consumers, such as low-carbon theme credit cards. However, the Industrial Bank's Corporate Social Responsibility Report states that the bank is committed to developing other green financial products, such as personal green financing, green funds, and green bonds. However, the total issuance amount is far lower than its corporate green loans. The bank's green loans are concentrated on energy-saving, environmental protection, and ecological loans, while relatively few are made for green consumption. Other commercial banks issue green credits in a manner akin to that of Industrial Bank. The rationale is that, compared to relying on outside assessment organizations for enterprise evaluation, statistically analyzing the low-carbon behaviour of green consumer consumers is more expensive and complex for commercial banks. Simultaneously, consumers have fewer avenues to learn about personal green finance products, and there needs to be more promotion of green consumer goods.

Still, the external incentive mechanism of green credit could be better, and there is a massive room for improvement. China's green credit has to put incentive policies in place because the financial institutions' pursuit of high-profit, short-term projects conflicts with the government's desire to establish green finance and grow a green economy. On the domestic front, we can investigate the experience that can be replicated and utilized as a guide by creating a green financial reform pilot zone. The reform pilot zone primarily employs financial, tax, and talent subsidies as incentives. At the same time, high-quality green assets are included in the scope of collateral or collateral through policies to promote commercial banks to issue green loans to enterprises in the reform pilot zone. Later, new cities such as Weihai, Chongqing and Guangzhou began to strive to join the green financial reform pilot zone. The success of the experimental area lies in making full use of regional characteristics and developing characteristic green industries. Summarizing the incentive measures with broad applicability, we need to expand the scope of the experiment, so the external incentive mechanism still needs to be continuously improved. Local governments mainly use specific monetary policy tools to encourage banks to issue green credit, such as refinancing, green funds, project guarantees, etc., but the implementation effect could be better. Except for the long-term capital operation of enterprise green projects, some enterprises still do not need to realize the benefits that green finance brings to the long-term development of enterprises, and some local governments still need to set up particular institutions to deal with this problem. At the same time, there are also situations in which the responsibilities of departments

about green finance could be more precise, and they forget each other. Although some places still rely on local financial self-regulatory organizations, the supervision power needs to be increased.

4 The development and problems of carbon emission reduction in the manufacturing industry

4.1 the development of carbon emission reduction in the manufacturing industry

According to the relevant data of the China Carbon Accounting Database, in 2019, the carbon emissions of the whole industrial chain of high energy-consuming manufacturing industries such as steel, chemicals and cement accounted for 35% of the national carbon emissions, so effectively reducing the carbon emissions of high energy-consuming manufacturing industries is an essential content of green development of manufacturing industries. In 2019, the carbon emissions of the steel industry accounted for 53% of the carbon emissions of the manufacturing industry, and its emission reduction is the most critical link to the carbon neutrality of the manufacturing industry. The most effective technical path to reduce emissions in the iron and steel industry is replacing it with electric arc furnace technology. The green development approach of the iron and steel industry is to improve energy efficiency by exploring green smelting technology. Whether it is carbon neutral or green, the challenge faced by the steel industry is that new technologies will substantially increase costs. Under the current low-profit margin in the steel industry, enterprises need more ability and motivation to carry out substantial technological upgrading. The chemical industry includes the petrochemical industry and the primary chemical industry. Although there are some differences in the industry, technologies such as carbon capture and storage and zero-carbon biomass raw material substitution are relatively mature. The industry can reach carbon neutrality in 2060 and peak carbon dioxide emissions in 2030. Cement production accounted for 14% of all carbon emissions in the country in 2019, with 1.3 billion tons of emissions.

Nevertheless, the cement industry needs a well-developed strategy for reducing emissions, and the greening of the supply chain is primarily driving the greening of the sector. As a result, the cement industry's carbon neutrality mainly rests on outside variables. The cement sector attains effective emission reduction and green development only when the economy continues to grow, cement demand declines and carbon capture technology costs dramatically decline. Even while the general manufacturing sector encompasses a wide range of industries, its carbon emissions make up less than 2% of China's overall carbon emissions, and the manufacturing sector continues to have a high level of green development. The general manufacturing industry's total carbon emissions in 2010 were 390 million tons, and each subsequent year saw a significant decline in emissions. It reached its peak carbon dioxide emissions in 2019 and fell by over 40% from 2010 levels. The general manufacturing sector is one of the most involved in green development and faces less pressure to achieve carbon neutrality.

The Ministry of Industry and Information Technology, the National Development and Reform Commission, the Ministry of Finance, the Ministry of Ecology and Environment, the People's Bank of China, the State-owned Assets Supervision and Administration Commission of the State Council, and the General Administration of Market Supervision released Guiding Opinions on Accelerating the Green Development of Manufacturing Industry in February 2024. By that time, the manufacturing sector had achieved remarkable results in reducing carbon emissions, the level of green development in traditional industries had increased significantly, the industrial structure and layout had been clearly optimized, and the ratio of green and low-carbon energy utilization had improved dramatically. The intensity of pollutants and carbon emissions has significantly dropped, the degree of comprehensive resource utilization has improved with time, and the total amount of carbon emissions has peaked. New forms of green integration have emerged, the essential capacity of green development has been dramatically improved, the competitiveness of green and low-carbon industries has been further enhanced, the role of green growth engines in emerging industries has become more prominent, and the scale and quality have been further improved. Reducing carbon emissions and fostering green development are now a solid basis for new industries. The documents that are currently available show that China's industrial sector will reduce its carbon emissions at a rapid rate in the future, with more significant practical effects.

4.2 The problems of carbon emission reduction in the manufacturing industry

First, China's manufacturing industry has been dominated by heavy industry for a long time, and these industries, such as steel, cement and chemical industries, are the primary sources of carbon emissions. The heavy industrial structure makes the task of emission reduction arduous. Second, Although China's manufacturing industry has made remarkable technological progress in recent years, there are still technical bottlenecks in some key areas, such as efficient energy utilization and low-carbon tech-

nology, which restrict the rapid improvement of the emission reduction effect. Third, China's energy consumption is still dominated by coal, which has a high carbon emission coefficient. Although substituting clean energy is actively promoted, adjusting energy structure still takes time and effort. Last, with the promotion of global climate control, the international community has increasingly strict requirements for carbon emissions. China's manufacturing industry may face more pressure to reduce emissions in the international market.

5 SWOT analysis of the impact of the Green Credit on carbon emission reduction in the manufacturing industry

5.1 The advantages

First, green credit can encourage manufacturing companies to invest in low-carbon technologies and environmentally friendly facilities to reduce carbon emissions. Second, with green credit support, manufacturing companies can adopt energy efficiency and carbon reduction technologies more efficiently, thereby reducing operating costs. Third, by participating in carbon reduction actions, manufacturing companies can improve their environmental image and attract more consumers and investors. Fourth, many governments and international organizations support green credit and have developed corresponding policies and incentives to encourage companies to reduce carbon emissions.

5.2 The disadvantages

Firstly, green credit faces financial constraints, resulting in only a few manufacturing industries receiving support, while other enterprises need help to obtain funding for environmental projects. Secondly, applying for green credit requires many documents and strict conditions, which may make some companies want to do it but cannot. Thirdly, some low-carbon technologies may need to be fully mature or have high costs, which may lead to companies needing to be willing to adopt these technologies. Simultaneously, adopting new low-carbon technologies may bring market risks, especially when there is low demand for environmentally friendly products or services.

5.3 The opportunities

From the perspective of opportunities, first of all, green credit can promote technological innovation, develop new low-carbon solutions, and provide more choices for manufacturing enterprises. Second, by reducing carbon emissions, manufacturing companies can enhance brand value and attract more consumers and investors. Third, as consumer demand for environmentally friendly products and services increases, manufacturing companies can meet market demand by adopting low-carbon technologies. Finally, with growing global concern about climate change, governments are likely to support carbon reduction actions further and provide more policy support and incentives for manufacturing companies.

5.4 The threats

From a threat perspective, the promotion of green credit to reduce carbon emissions in the manufacturing industry mainly faces the following issues:

Firstly, China's manufacturing industry has long been dominated by heavy industries, such as steel, cement, and chemical industries, which are the primary sources of carbon emissions. Our country's heavy industrial structure makes carbon reduction arduous.

Secondly, there is a technical bottleneck. Although China's manufacturing industry has made significant technological progress in recent years, there are still technological bottlenecks in critical areas, such as energy efficiency utilization and low-carbon technology, which restrict the rapid improvement of carbon emissions reduction.

Thirdly, China's energy consumption is still dominated by coal, which has a relatively high carbon emission coefficient. Although replacing clean energy is actively promoted, adjusting the energy structure requires more time and effort.

Finally, with the advancement of global climate control, the international community's requirements for carbon emissions are becoming increasingly stringent. China's manufacturing industry may face more significant carbon emissions in the international market.

Table 1 SWOT analysis model of the Green Credit boosting carbon emission reduction in the manufacturing industry

Strengths	Weaknesses
1. Promote investment	1. Financial constraints
2. Reduce costs	2. Technology maturity effect
3. improve your image	3. The application process is complicated
4. Policy support	4. Market risk

Opportunities	Threats
1. Technological innovation	1. Heavy industrial structure
2. Brand value enhancement	2. Technical bottleneck
3. Increased policy support	3. Energy structure problem
4. Market demand growth	4. International trade pressure

6 PEST analysis model

6.1 Analysis of the Political Environment

From the perspective of the policy environment, the main policy factors affecting green credit to promote the manufacturing industry to reduce carbon emissions are government environmental policies and regulations. The government regulates and promotes carbon emission reduction by enterprises through environmental policies and regulations. Green credit is generally provided with government support through preferential loans, tax breaks or other measures to encourage manufacturers to adopt low-carbon technologies and implement carbon reduction. Then, there are government grants and subsidies. Governments can provide subsidies or grants to manufacturing companies to support their carbon reduction activities. These subsidies can be combined with green credit to provide more financial support to enterprises.

6.2 Analysis of the Economic Environment

Economic factors are primarily energy prices and costs. The fluctuation of energy prices and changes in costs will affect the willingness of manufacturing enterprises to adopt low-carbon technologies. If energy prices and costs are too high, companies may want to invest more in improving energy efficiency and reducing carbon emissions. Next is financial support. Green credit can help manufacturing companies provide financial support to invest in carbon reduction. Finally, there is brand value. The carbon reduction supported by green credit is manifested as enterprises can enhance their environmental image and attract more consumers and investors, thereby increasing their income and profits.

6.3 Analysis of Social Environment

From the social environment perspective, the first influencing factor is public opinion. Growing public concern about environmental protection has prompted governments, businesses and financial institutions to pay more attention to carbon reduction. Then, there is consumer preference and demand. The increasing consumer preference and demand for environmentally friendly products and services is driving manufacturing companies to adopt more carbon reduction measures. Green credit can help enterprises meet the needs of consumers and improve market competitiveness. Finally, there are demographics and the Labour market. Demographic changes and labour market demands will also affect carbon reduction in manufacturing. For example, an ageing population may prompt companies to adopt more energy-saving and environmentally friendly measures, which green credit can finance.

6.4 Analysis of Technical Environment

From the perspective of the technological environment, the most crucial factor is technological innovation and development. Technological innovation and development provide more choices and opportunities for carbon reduction in the manufacturing industry. Emerging low-carbon technologies and solutions can be promoted and applied through green credit support. Next are technical feasibility and sustainability. Manufacturing companies consider feasibility and sustainability when choosing carbon reduction technologies. Green credit can support carbon reduction projects that are technologically mature, economically feasible, and sustainable. Finally, there are technical standards and specifications. Green credit may require companies to adopt technology, equipment, and processes that comply with environmental standards and regulations. These standards and regulations can encourage companies to adopt more environmentally friendly technologies and reduce carbon emissions.

Table 2 PEST analysis model of green credit boosting carbon emission reduction in the manufacturing industry

Political Environment	Economic Environment
1. Environmental policies and regulations.	1. Energy price and cost.
2. Government subsidies and subsidies	2. Financial support.

	3. Brand value.
Social Environment	Technology Environment
1. Public opinion.	1.Technological innovation and development.
2. Consumer preferences and needs.	2. Technical feasibility and sustainability.
3. Demographic structure and labour market.	3. Technical standards and specifications.

7 Conclusion

Based on the above research, the following conclusions have been drawn: In recent years, the development status of green credit mainly includes the increasing scale of green credit, the gradual improvement of green credit policies, and the continuous enrichment of green credit projects; The advantages of green credit in promoting carbon reduction in the manufacturing industry include promoting investment, reducing costs, improving image, and obtaining policy support. The disadvantages mainly include funding constraints, mature technology effects, complex application processes, and market risks. The opportunities mainly include technological innovation, increased brand value, policy support, and market demand. The challenges mainly include heavy industrial structure, technological bottlenecks, energy structure issues, and international trade pressure.

To further promote the role of green credit in reducing carbon emissions in the manufacturing industry, this paper puts forward the following suggestions based on the above analysis:

Firstly, government departments should introduce more explicit green credit policies, set emission reduction targets and incentive measures, and ensure that green credit funds can be accurately invested in energy-saving emission reduction and environmentally friendly manufacturing projects through policy guidance.

Secondly, we should encourage each market theme to develop more green credit products that meet the characteristics of the manufacturing industry, establish and improve the green credit market mechanism, and meet enterprises' diversified financing needs.

Thirdly, it is necessary to enhance manufacturing enterprises' environmental awareness and encourage them to innovate and upgrade. The government can provide tax breaks, subsidies, and other preferential policies for enterprises actively participating in green credit projects.

Finally, We should establish a performance evaluation system for green credit projects, regularly evaluate their emission reduction effects, and timely adjust credit strategies to reduce risks.

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